Claims

[c1] 1. A method for determining a cylinder specific performance parameter for a cylinder of a multi-cylinder internal combustion engine, comprising the steps of:
determining a performance parameter representative of engine output across a first group of cylinders based on an engine operating parameter;
determining a cylinder deviation parameter representative of engine output of a single combustion event in the cylinder; and
calculating the cylinder specific performance parameter based on said performance parameter and said cylinder deviation parameter.

[c2] 2. The method of claim 1 wherein said group of cylinders comprises all cylinders in the engine.

[c3] 3. The method of claim 1 wherein said group of cylinders comprises cylinders in a cylinder bank of the engine.

[c4] 4. The method of claim 1 wherein the engine is a variable displacement engine having some engine cylinders that are deactivatable and said first group of cylinders comprising activated cylinders.

[c5] 5. The method of claim 1 wherein said performance parameter is based on air charge.

[c6] 6. The method of claim 1 wherein said cylinder deviation parameter comprises engine rotational acceleration deviation defined by a difference between a cylinder specific rotational acceleration associated with the combustion event in the cylinder and average engine rotational acceleration.

[c7] 7. The method of claim 6 wherein said cylinder specific rotational acceleration and said average engine rotational acceleration are based on a signal from a crankshaft position sensor coupled to the engine.

[c8] 8. The method of claim 1 wherein said cylinder deviation parameter comprises torque deviation defined by a difference between a cylinder specific torque associated with the combustion event in the cylinder and average engine

[c9] 9. The method of claim 8 wherein said cylinder specific torque and said average engine torque are based on a signal from an in-line torque sensor coupled to an output shaft of the engine.

[c10] 10. The method of claim 1 wherein the engine has spark plugs disposed in the cylinders and said engine performance parameter is based on a spark timing of the engine.

[c11] 11. The method of claim 1 wherein said cylinder specific performance parameter is cylinder specific indicated mean effective pressure.

[c12] 12. The method of claim 1 wherein said performance parameter is based on a neural net model.

[c13] 13. The method of claim 1 wherein said performance parameter is based on a fuel pulse width commanded to fuel injectors disposed in the engine.

[c14] 14. The method of claim 1 wherein said performance parameter is based on a timing of said fuel injection, said timing is measured relative to said engine rotational position.

[c15] 15. A method for estimating a cylinder specific performance parameter for a cylinder of a multi-cylinder internal combustion engine, comprising the steps of:
determining a rotational speed of the engine over a prior time interval;
determining an engine rotational acceleration deviation associated with a single combustion event in the cylinder based on said rotational speed;
determining a value of a performance parameter representative of engine output across a group of engine cylinders; and
determining the cylinder specific performance parameter based on said engine rotational acceleration deviation and said performance parameter.

[c16] 16. The method of claim 15, further comprising the steps of:
determining a cylinder specific rotational acceleration associated with the combustion event in the cylinder based on said rotational speed of the engine;
determining a rotational acceleration average based on said rotational speed,

said rotational acceleration average is averaged over all cylinders of the engine; and

determining said engine rotational acceleration deviation based on the difference between said cylinder specific rotational acceleration and said rotational acceleration average.

[c17] 17. The method of claim 15 wherein said performance parameter associated with a group of cylinders is based on output of one or more sensors coupled to the engine.

[c18] 18. The method of claim 17 wherein said sensors provide information indicative of said group of cylinders.

[c19] 19. The method of claim 15 wherein said rotational acceleration average is based on a median value of rotational acceleration over said prior time interval.

[c20] 20. The method of claim 15 wherein said prior interval comprises less than about two revolutions of the engine.

[c21] 21. The method of claim 15 wherein the cylinder specific performance parameter is indicated mean effective pressure of the cylinder.

[c22] 22. The method of claim 15 wherein said performance parameter associated with said group of cylinders is based on a mass rate of airflow to the engine.

[c23] 23. The method of claim 15 wherein the engine is spark ignited and said performance parameter associated with said group of cylinders is based on a mass rate of airflow to the engine and a spark timing of the engine.

[c24] 24. The method of claim 15 wherein said group of engine cylinders comprises all cylinders in the engine.

[c25] 25. The method of claim 15 wherein said group of engine cylinders comprises cylinders in a cylinder bank of the engine.

[c26] 26. The method of claim 15 wherein said engine performance parameter associated with said group of cylinders is based on a fuel pulse width commanded to fuel injectors disposed in the engine.

[c27] 27. The method of claim 15 wherein said engine performance parameter associated with said group of cylinders is based on a timing of said fuel injection, said timing is determined relative to said engine rotational position.

[c28] 28. The method of claim 15, further comprising the step of determining whether a misfire event has occurred in the cylinder based on said cylinder specific performance parameter.

[c29] 29. A system capable of computing an indicated mean effective pressure for a cylinder of an internal combustion engine, said cylinder being a member of a group of cylinders in the engine, said system comprising:
a crankshaft position sensor coupled to the engine; and
an electronic control unit operably connected to the engine and said crankshaft position sensor, said unit determining an engine rotational acceleration deviation for a single cylinder based on a signal from said crankshaft position sensor, said unit further determining indicated mean effective pressure for all cylinders of the engine, said unit further determining the cylinder specific indicated mean effective pressure of the cylinder based on said engine rotational acceleration deviation for the cylinder and said indicated mean effective pressure for the engine.

[c30] 30. The system of claim 29 wherein said indicated mean effective pressure for the engine is determined based on a signal from at least one sensor coupled to the engine.

[c31] 31. The system of claim 29, further comprising a mass air flow sensor coupled to an intake of the engine, said indicated mean effective pressure for the engine is determined based on a signal from said mass air flow sensor.

[c32] 32. The system of claim 29, further comprising a manifold absolute pressure sensor coupled to an intake of the engine, said indicated mean effective pressure for the engine is determined based on a signal from said manifold absolute pressure sensor.

[c33] 33. The system of claim 29 wherein said indicated mean effective pressure for the engine is determined based on a value of fuel pulse width commanded to

fuel injector disposed in the engine.

[c34] 34. The system of claim 29 wherein said indicated mean effective pressure for the engine is determined based on ignition timing.

[c35] 35. A computer readable storage medium having stored data representing instructions executable by a computer to compute a cylinder specific performance parameter for a cylinder of an internal combustion engine, said cylinder being a member of a group of cylinders in said engine, comprising:
instructions to determine a value of a measured engine quantity over a prior interval;
instructions to determine a deviation value of said measured engine quantity, said deviation value being associated with a single combustion event in the cylinder;
instructions to determine a performance parameter representative of engine output across the group of cylinders; and
instructions to determine the cylinder specific performance parameter for the cylinder based on said deviation value and said performance parameter of said group of cylinders.

[c36] 36. The medium of claim 35 wherein said performance parameter associated with the group of cylinders is based on one or more of spark timing, fuel injection timing, air flow, and fuel pulse width.

[c37] 37. The medium of claim 36 wherein said measured engine quantity is engine rotational acceleration, which is based on a signal from a crankshaft position sensor coupled to the engine.

[c38] 38. The medium of claim 35 wherein said measured engine quantity is engine torque, which is based on a signal from an in-line torque sensor coupled to the engine.

[c39] 39. The medium of claim 35 wherein the group of cylinders comprises all engine cylinders.

[c40] 40. The medium of claim 35 wherein the cylinder specific performance

parameter is computed for each fuel providing event to each cylinder.

[c41] 41. The medium of claim 35 wherein the cylinder specific performance parameter comprises cylinder specific indicated mean effective pressure.

[c42] 42. The medium of claim 35 wherein the cylinder specific performance parameter comprises cylinder specific work.

[c43] 43. The medium of claim 35 wherein the cylinder specific performance parameter comprises cylinder specific torque.

[c44]